AN OPTIMAL POLICY FRAMEWORK FOR A NEW BROADBAND NETWORK

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1. SUMMARY AND OUTLINE

While there are at least seven full facility-based broadband competitors, competitive facility-based *fixed* line investments appear to be declining in favour of use of Telstra's network. It also appears that no carrier is presently willing to make significant fixed broadband investments without substantial regulatory commitments and protections relative to those currently available.

Because of its frustration with the present lack of broadband development, the Australian government has announced that it is willing to spend as much as $4 billion to facilitate deployment of a national broadband network (NBN) with open wholesale access at a uniform price to reach 98 percent of Australia's population (Conroy, 2008). This paper reviews the government's tender in the context of how regulatory policy can obtain efficient rollout of, and ongoing development and use of next generation (broadband) networks (NGNs).

The paper begins, in Section 2, by examining what may be driving carriers' present unwillingness to invest. The section finds that commitment to fixed broadband networks, which requires substantial sunk investments,[1] but only promises highly uncertain returns, is unlikely when regulatory discretion is broad and expected to be widely exercised. Instead, if efficient investment in NGNs is to be forthcoming, a strong and credible commitment to minimal regulation, including of access, is called for. Section 3 further shows that the general characteristics of NGN supply reinforce this conclusion. That is, anything more than minimal regulation of NGNs will materially harm efficient service development and network use.

If minimal regulation is necessary to ensure efficient incentives to invest in an NBN, this raises concerns about whether an NBN provider (or providers) might engage in efficiency distorting monopoly practices. Section 4 finds that if regulation must be imposed to address that harm, then wholesale price caps are one solution that has merit. That said, the uniform pricing conditions of the government's tender, when coupled with anchor pricing, will also effectively constrain monopoly pricing. In the light of that, we propose an approach to anchor pricing that can also address the issue of changes over time in the relevant anchor service. Section 5 considers the risks of vertical discrimination, but also finds these are too easily overstated, as are the net benefits of imposing operational or vertical separation.

Section 6 concludes that none of this implies the government's tender is a sensible idea. It might well be better to simply fix the regulatory regime and then let investment decisions flow

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1 An investment is sunk if it can only be used for its original purpose, and cannot be applied toward any use. Thus, once fibre is buried, it is literally and economically sunk. It cannot be used for any other purpose except for communicating along its length and has no scrap value. Similarly, the costs of laying a copper cable less the scrap value of the copper, net of extraction costs, are sunk.

(including decision about whether to deploy FTTN). Any concerns about universal service could then be dealt with by transparent means, such as a transferable voucher scheme. In contrast, the government's approach unnecessarily runs all the risks of 'picking winners'.

2. ROBUST COMMITMENTS NOT TO EXPROPRIATE

The chief contention of this section is that a robust commitment to light-handed regulation of NGNs is critical to the development and use of NGNs, and hence the deployment of an NBN. The fundamental reason for this is that NGN deployment requires substantial long-term sunk investments and this leaves investors vulnerable to regulatory holdup, a problem the present regulatory regime makes especially acute.

In what follows, section 2.1 outlines the problem—that despite broad entry, investment, both in the current fixed network and most especially in fixed NGNs, has been weak. At a basic level, this must be because investors do not expect to earn a return that would justify the costs and risks NGN deployment would entail. Of particular importance to investors are the substantial risks that arise because NGN investments require costly upfront commitments that once made cannot be escaped (section 2.2). Such risks create opportunities for holdup, and it is the potential for regulatory holdup that makes regulatory commitments not to expropriate sunk investments vital to NGN deployment (section 2.3).

2.1. INVESTMENT LAGS DESPITE WIDESPREAD COMPETITION

The range and diversity of active broadband suppliers in Australia (ACCC and ACMA, 2007, pages 9, 11) suggests a highly competitive industry, as the following list of broadband competitors' networks (and, in parentheses, coverage) indicates:

- Telstra's copper, hybrid fibre coaxial (HFC) and mobile networks (99% of the Australian population);[2]
- Optus' HFC network (which passes 1.4 million homes in Melbourne, Sydney and Brisbane) as well as its mobile broadband and wireless network ("approximately 80% of the Australian population");[3]
- Neighbourhood Cable's HFC network (regional Victoria);
- Transact's fibre network (Canberra);
- Unwired's WiMax service (Melbourne and Sydney);[4]
- Vodafone's 3G and wireless network (presently covers most urban areas in Australia, but expects coverage of 95% of the population by the end of 2008);[5] and

[2] Telstra's (2008a) 3G service offers download speeds of "550Kbps to 1.5Mbps"; on coverage see Telstra (2008b).

[3] Optus' wireless network offers download speeds of up to 3.6 Mb/s (Foo, 2008); on coverage see Optus (2008).

[4] "Fast and Always on with speeds up to 1Mbps" (Unwired, 2008).

[5] Vodafone claims wireless download speeds of 7.2 Mb/s on its Internet-enabled USB devices (Foo, 2008); Vodafone (2008b) intends on "reaching 95% of the places people live or work in Australia" "by Christmas 2008", but presently covers "metropolitan areas in Sydney, the NSW Central Coast, Melbourne, Canberra, Adelaide, Perth, Brisbane, the Gold Coast and the Sunshine Coast, plus all international airports in Australia".

- Hutchison's 3G network ("the greater metropolitan areas of most Australian capital cities, and plenty of others places too").[6]

Despite the apparent health of broadband competition, when it comes to sunk investments, especially in fixed networks, there are signs of serious problems. Three stand out. First, Telstra appears to be the sole source of growth in fixed line investments, while competitive fixed-line carriers seem to prefer regulatory access to Telstra's network (Ergas, 2008b;[7] Cave, 2007). Second, a significant part of Telstra's investments may not be market driven, but rather may be forced by stringent service quality requirements and accompanying penalties. However, coercion cannot efficiently induce investment in new networks. Thus, observed investment in all likelihood overstates future investments. Third, and perhaps most importantly, Australian carriers have demonstrated an unwillingness to follow their overseas counterparts in making any significant investment in NGNs without substantial regulatory pre-commitments (for example, see Burgess, 2006; and FANOC, 2007, notably at page 15).

2.2. SUNK COSTS AND UNCERTAIN RETURNS

At a basic level, this reticence to invest arises because high sunk costs and uncertain future income streams characterise NGNs. As much of the subsequent discussion of this paper will explain, these factors create substantial risks for investors, and have fundamental implications for the kind of regulatory environment that is likely to induce efficient investment in, and use of, a NBN.

NGN rollout requires two key types of sunk investments:

- the initial deployment of a next generation access network (NGAN) (Montagne, 2008, page 36[8]), as once a new access loop is placed, those loops have little other value except to provide electronic communications; and
- the cost of bringing on new services, including:
  - the costs of managing the transition from the existing network and services to the new network and services;
  - development of customer premise and service provider equipment/software/content/etc.;
  - future costs of upgrading the NGAN, for example, from a fibre-to-the-node (FTTN) to a fibre-to-the-premise (FTTP) network (Montagne, 2008, page 36[9]); and
  - market development costs, including the risk of a substantial period of losses before penetration reaches sustainable levels;

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6 "Broadband speed at the range of 600kbps – 1.5mbps" (Hutchison, 2008).

7 On Optus, see chapter 3, on Transact, see section 10.1.3.

8 Montagne estimates a green field FTTN network costs approximately €500 (AUD800) per connection; the bulk of these costs are sunk. AT&T's FTTN U-verse network is estimated to cost USD330 per premise (Stump, 2007).

9 An FTTP may be necessary for some high bandwidth services. Montagne estimates a green field FTTP network costs approximately €1,500 (AUD2,500) per connection. Verizon appears to be spending USD1,280 per premise in rolling out its FTTP Fios network (the total cost of the project is $23 billion (http://www.onetrak.com/ShowArticle.aspx?ID=3168) with 18 million premises to be passed (http://www.onetrak.com/ShowArticle.aspx?ID=3461)). This is consistent with Ante's (2007) estimate that Verizon's line cost is more than three times as much as AT&T's FTTN U-verse network (see previous footnote).

since again, costs incurred for research and development, training, and advertising designed to develop and promote a specific service and similar typically provide no other value if the service fails.

While the network provider will largely incur the initial deployment sunk costs, retail suppliers (including the network provider's retail operations) could incur a substantial proportion of the sunk costs of service development.

At the same time, NGN investors face a high degree of uncertainty about the development of both technology and demand, creating the risk that the large sunk costs of a NGN will not be recovered. There are three components to this risk:

- Technological developments, for example, in wireless or broadband over power lines, could lead to low cost competition that would render some part of fibre investments unrecoverable.
- Realised demand may not turn out to be capable of recovering unsalvageable costs. For example, future demand for use of NGNs is, in large part, unknowable, as it involves services not yet developed and perhaps not yet thought of. This is all the more the case as ultimate cost recovery is likely to depend on demand for very high speed services (at 50 Mbps and above), for which there are currently very few applications. Thus, it may turn out that demand could never recover sunk NGN costs.
- Once assets are sunk, third parties that have power to hold the project up can expropriate revenues necessary for the investor to recover its costs. To see this, consider two parties, one that uniquely values a service, say an access line to its business, and another that can efficiently supply the service for $100. If the supplier were to sink $90 to provide that service without an enforceable agreement with the (unique) potential buyer, then the buyer can engage in holdup. For example, the buyer might offer as little as $11 for the service, even if it valued the service in excess of $100, and the supplier, not being able to sell the service to anyone else, might be forced to accept that offer (and likely would do so, if the offer exceeded the variable costs it needed to incur and accepting it would not unleash similar demands by others).

Further, these technological and demand risks are mutually reinforcing. For example, it is not merely the case that, say, wireless or broadband over power lines could render some part of fibre investments unrecoverable, nor that consumer demand may not turn out to justify those investments. It is also that there are, for example, great uncertainties as to how to develop retail demand, and whether any given failure in that arena can be attributed to underlying network failures, a failure of retail execution, or simply the fact that the demand was not there. Thus, the expected returns on underlying and largely sunk network will be heavily influenced by the strength of downstream demand, which in turn will depend on both how investments are sunk to create that demand, including to develop services not presently available or even imagined, and (to close the circle) on the underlying network investments. As Section 3.2 below shows, these interdependencies between different up- and downstream levels of the market turn out to be of critical importance in designing an efficient regulatory regime.

2.3. SUNK COSTS, REGULATORY HOLDUP AND COMMITMENT

The prospect of holdup is highly relevant to regulation of the NBN. The subject of this section is regulatory holdup,[10] that is, opportunistic behaviour on the part of the regulator to force the regulated firm, having sunk its assets, to pass quasi-rents[11] onto third parties such as consumers or entrants (Gómes-Ibañez, 2003, page 2[12]). In particular, the regulator may seek to set prices so low that the firm cannot recover its sunk costs, but still has incentives to continue to operate.

Regulators may be tempted to undertake such expropriation because:

- such policies can be claimed to not distort, and even to improve, short run allocative efficiency, because they expropriate quasi-rents, bring prices closer to short run marginal costs (in practice, short run distortions are likely as inappropriately administered rent transfers induce inefficient entry or expansion or consumption); and
- cutting prices, at least in the short run, may be politically attractive over the time period during which the regulator is likely to bear responsibility for such actions. Voters are likely to notice and appreciate lower prices, while the costs of any short run distortions caused by such a policy and the need for long run price increases will be less well understood. As a result, regulatory underpricing appears common (on the US, see Hausman and Sidak, 2005, *passim*, but especially the second paragraph of section IV(B), and Crandal, Ingraham *et al*, 2004; on Europe, see Gruber, 2007, and on Australia, see subsection 2.3.1 below).

The risks of such regulatory expropriation are made all the greater by the inherent uncertainties involved in regulatory cost determination. Especially, but not only, when regulators rely on complex cost models to determine access charges, there is always scope for a regulator to claim that conduct that is in fact expropriation merely involves a difference of views as to the appropriate level of recoverable costs.

Expropriation of quasi-rents has very substantial negative consequences. In particular, any firm that potentially may be similarly regulated (that is, not just the expropriated firm) will hesitate to make new and efficient sunk investments. Indeed, merely the potential for expropriation will inefficiently dampen investors' incentives. Consequently, to ensure efficient investment incentives, the regulator must credibly commit to not expropriate the firm once the investment is largely sunk.

The risk of regulatory expropriation is particularly high when firms are considering rolling out new fixed line infrastructure for two reasons. First, the more a potentially regulated firm's cost are sunk, the greater the potential losses of regulatory holdup, and fixed-line networks

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10 The regulatory implications of hold-up between up- and downstream firms in a vertical supply chain are discussed in section 3.2 below.

11 A quasi-rent is income that can be lost without affecting an agent's short run behaviour, but which is necessary to recover the costs of any assets sunk in that short run. In the example of section 2.2, the quasi-rents were $89 ($100 - $11).

12 Gómes-Ibañez (2003, page 3) notes that the network provider may also have market power, in part because end-users have made sunk investments that make it hard for them to choose service from an alternative supplier. However, to the extent that such market power exists, it may not result in statically inefficient prices, especially if the firm faces high fixed and low marginal cost and so has strong incentives to expand output. Further, prices that harm static efficiency may bring consumer benefits through dynamic efficiencies that would not be gained in their absence. In contrast, regulatory opportunism never benefits the regulated firm or dynamic efficiency.

require very substantial commitments to sunk costs. Second, because telecommunications is such a fundamental part of the economy and everyday life, substantial political capital can be gained by reducing short run prices, which means that the likelihood of regulatory opportunism is high.[13]

2.3.1. The risk of regulatory holdup appears high in Australia

The present Australian regulatory environment provides unfortunate evidence of holdup. As noted at the end of section 2.1 above, Australian carriers are deeply concerned about the risk of regulatory holdup, and will not make substantial investments in an NBN without *ex ante* regulatory commitments.

This is not surprising. Investors can be expected to avoid sinking large amounts of capital where the regulator can exercise substantial regulatory discretion, actively exercises that discretion, and does so in a manner that commonly leads to underpricing. This appears to characterise Australian telecommunications regulation.

Ergas (2008b, chapter 6) documents the extent of regulatory discretion allowed the ACCC by the current telecommunications regime. In particular:

- the ACCC's choice of what to regulate ("declare", in the language of the *Trade Practices Act* 1974 (TPA)), is essentially unchecked;
- once it declares a service, it faces few constraints beyond a vague list of statutory objectives on how the regulated terms and conditions of access to that service are set; and
- its arbitration determinations on terms and conditions, including prices, are not subject to any merits review.[14]

As a result, the ACCC can set access charges without regard to clear principles, criteria or rules. In this environment, it has chosen an access pricing methodology (forward-looking long run incremental cost modelling) that relies on myriad, essentially untestable, judgements that have produced access charges that do not sum to total costs, distort relative prices for closely substitutable inputs, and are not time-consistent. It is not surprising that such a pricing methodology has serious efficiency problems (Vogelsang, 2002, pages 20-23; Ergas, 2008b, section 7.2) that worsen over time and with competition (Vogelsang, 2002, page 22).

[13] Regulatory opportunism is less likely when investments are short-lived and demand growth is high (necessitating frequent reinvestment). NGAN investments are likely to be relatively long-lived but demand growth may (or may not) be high.

[14] The ACCC also makes decisions with respect to Undertakings (essentially, commitments an access provider can make with respect to the terms and conditions on which it will supply third party access). Once accepted by the ACCC, the terms and conditions set out in such an Undertaking are binding on the ACCC in the event of an access dispute. However, for reasons set out in (Ergas, 2008), the Undertaking mechanism has not been effective.

Moreover, the ACCC has approached this task with great energy. An extensive and, to date, increasing range of telecommunications services have been subjected to mandatory third party access. More than a decade on, ten services are declared—ISDN origination, ISDN termination, line sharing, unconditioned local loop service (ULLS), mobile terminating access, local carriage service (LCS), wholesale line rentals (WLR), PSTN originating access, PSTN terminating access, and DDAS (ACCC, 2008a)—and no declarations have been withdrawn outside of narrow geographic areas or because they were or became redundant (ACCC, 2008b). In CBDs, LCS was withdrawn and WLR not required; inter-capital transmission has been withdrawn, while OA, LCS and WLR may be withdrawn where the ACCC considers that ULLS competition is established.

At the same time, the ACCC's cost estimates are subject to a powerful downward ratchet (Ergas, 2008b, section 8.4; Ergas, 2008c), and prices appear to be set without accounting for either the option value of providing spot market access (compare with Pindyck, 2004, and Guthrie, 2006) or the likelihood of regulatory error (Ergas, 2008a, pages 6-8; see also Productivity Commission 2001, pages 398-399). This coupled with aggressive declaration of services that are close substitutes (for example, the unbundled local loop service, or ULLS and the line sharing service, or LSS[15]) make regulatory underpricing highly probable, even if it is not intentional (Ergas, 2008a, pages 119 and following). Indeed, the regulatory underpricing of access to Telstra's network may be part of the explanation for the failure of full facility carriers in Australia such as iBurst.

The result is a scissor effect cutting investment. The regulatory hold-up blade discourages regulated carriers from maintaining existing investments, and prevents commitments to new investments that could be regulated. The other blade cuts investment in competitive infrastructure by carriers that are unlikely to be regulated, but who have some expectation of gaining access to regulated assets. Instead, actual and potential access seekers have strong incentives to hold off investing in infrastructure because access to a third party's investments are or are likely to be forced on favourable terms.

2.3.2. Policy implications

The conclusion is that in an environment, such as that which presently characterises Australia, where both the regulator's capacity and temptation to engage in regulation are high, efficient investment incentives call for strong commitments against expropriating behaviour.

Regulatory commitments, broadly speaking, can take many forms. The US Federal Communications Commission (FCC) provides a specific example in choosing not to regulate NGNs. A less restrictive commitment would be to not regulate the NBN for a guaranteed period of time, potentially subject to a review with specified terms of reference at that point. (A potential regulatory review, of course, also distorts incentives, for example, because access seekers may believe that waiting for future regulatory intervention, instead of investing, will allow them to obtain rents, even if this is inefficient from the perspective of the broader society. However, this distortion is somewhat weakened if a review is not guaranteed, but only possible. Interestingly, the threat of review also dampens the NBN's

[15] Similarly, ULLS, LSS and wholesale line rental (WLR) combined with the local call service (LCS) and originating access (OA) are substitutes in the supply voice of voice services, and LCS and OA are substitutes in call termination. Every time a substitute is regulated the probability that access is underpriced over the group of substitutes rises, since access seekers will tend to use the lowest price substitute.

incentives to exercise any market power that it might have, at least to the extent that this might either postpone a review or lead to relatively light-handed regulation at review.)

It should also be recognised that regulatory commitments can be difficult to maintain and that this strengthens the need for maximal commitment. Regulatory commitment requires identifying terms and conditions that will remain appropriate over an extended period, which is perhaps impossible. As a result, if outcomes are realised under past commitments that are difficult to sustain economically or politically, then they are unlikely to be allowed to persist. For example, if, because of unseen events, past commitments look likely to force an efficient regulated firm into bankruptcy or grant the firm extraordinary windfall gains, those commitments will be, with some probability, revoked. This has benefits (it allows adjustment in the face of substantial change) and costs (the inevitable blunting of regulatory incentives), but the point here is that unwavering commitments are hard to make, and this opens the door to regulatory opportunism.

It is striking for example, that New Zealand, when it deregulated its telecommunications system in the late 1980s adopted a very light handed approach, and seemed to show a high level of commitment to that approach; moreover, there is some evidence that that approach yielded significant benefits in terms of stimulating investment, productivity growth and retail price reductions (Ergas, 1996). However, in part because of Telecom Corporation of New Zealand's (TCNZ) high market share and high profits, as well as continuing access disputes between TCNZ and access seekers, that regime was scrapped in the late 1990's. Since then, New Zealand has shifted to a relatively intrusive regulatory arrangement, which has had substantial adverse effects on TCNZ and NGN investment.

While making regulatory commitments as rigid as possible so as to make reversals only likely in exceptional circumstances may seem to be costly, it in fact yields net benefits. At best, it reduces the expectation of inefficient regulatory reversal, thereby allowing investment that generates substantial social surplus, but also allows regulatory change when it is necessary. At worst, such commitments have little effect, and hence are not likely to prevent changes when they are necessary, but equally will not prevent regulatory opportunism, with consequent harm to efficient investment incentives.

Regulatory holdup can also be made less likely if commitments are bolstered by *ex ante* legislation and contractual protection, and to the extent there is a broad awareness of the harms holdup imposes. Political constituencies, such as the readers of this document, and relevant institutions, such as the courts, the public service, parliaments and regulatory bodies, can facilitate such awareness. As an example, consider the widely accepted view that the Reserve Bank should not undertake policy that might provide short-term stimulus, but create long-term inflationary harm. Together with commitments from the government (including through the Statement on the Conduct of Monetary Policy, which sets the agreed inflation target), this creates a culture that reduces the likelihood of regulatory opportunism.

Finally, the risk of regulatory opportunism is reduced if regulatory regimes have relatively broad coverage, rather than being specific to particular industries. As Ergas, 2008 emphasises, one of the factors that has facilitated the ACCC's conduct in telecommunications is the highly bespoke nature of the telecommunications regime. This reduces the extent to which other (current or potential) regulated industries monitor the ACCC's conduct and exercise political pressure for the discretion vested in the ACCC to be curbed or better controlled.

In summary, potential NBN investors recognise that broadband deployment is particularly susceptible to regulatory holdup. Consequently, public, legislative and contractual commitments that reduce the prospects for *ex post* expropriation, notably through discretionary price setting procedures, are essential to ensure efficient investment in the NBN.

3. THE TENDER AND REGULATION

The preceding sections have argued that a regulatory commitment to avoid expropriation is necessary to ensure incentives to invest in broadband technologies are not inefficiently muted. Yet, even putting these investment incentives aside, the case for anything more than the most minimal regulation of NGNs is weak. Section 3.1 shows that regulation of new highly dynamic markets, as characterises service supply over NGNs, will be particularly distorting, and hence many regulatory approaches can be expected to fail a cost-benefit test. At this level alone, a *prima facie* case can be made that access regulation should be avoided. Moreover, the specific cost structure of broadband supply suggests access regulation would be particularly distorting (section 3.2).

3.1. REGULATING A DYNAMIC NEW MARKET IS HIGHLY COSTLY

Regulation, because it carries high costs (Carlton and Perloff, 2005, pages 682-685; Noll, 1989; and Hahn, 1998), should not be imposed unless there is a strong case that no action would lead to substantively greater harm (Kahn, 1988, pages 11-12; Farrell, 1997; Neuchterlein and Weiser, 2007, pages 428-429; *Re Duke Eastern Gas Pipeline Pty Ltd* [2001] ACompT 2 (4 May 2001); ACCC, 2008a[16]). This is particularly so when new investments (as discussed in section 2 above) and new services (Romer, 1994; Hausman, 1997[17]) are at stake, as then the resulting losses in social surplus are especially great (Guthrie, 2006, *passim*, but especially pages 939-940, 960-966 and 968-969; Powell, 1999; ACCC, 2005, pages 18-19; Ofcom, 2007[18]). It is worth emphasising that "new investments and new services" very much characterise the NBN.

Access regulation also provides a mechanism by which firms with short time horizons can postpone more efficient, but also more radical, change (Belletini and Ottaviano, 2005).[19] Firms with short time horizons are, by definition, less likely to sink investments when cost recovery can only be expected over the long term. They would prefer to eke out additional productivity gains from exploiting already sunk investments (especially if these investments were made by someone else). Yet, it is exactly long-term investments that are necessary for full-facility competition, which may (1) bring more effective competition than that based on access regulation (ACCC, 2007, pages iii,[20] 21; Nuechterlein and Weiser, 2007, pages 428-

16 "Regulation will only be desirable where it leads to benefits in terms of lower prices, better services or improved service quality for end-users that outweigh any costs of regulation."

17 Schwartz (2008, pages 430-431) argues access regulation in telecommunications has been "relatively successful when the access technology was mature and relatively simple."

18 In particular, Annex 5 to the Ofcom consultation, where a thorough assessment of the costs and benefits of VoIP regulation is undertaken.

19 A firm may have a short time horizon as a result of a profit-maximising sunk cost in (commitment to) understanding an existing technology.

20 "[W]here it is economically efficient, facilities-based competition is more likely to promote the [long-term interests of end-users]… because this form of competition allows rivals to differentiate their services and compete more vigorously across greater elements of the supply chain."

429), and (2) obviate the need for regulation. Both of these factors are likely lead to substantially more efficient long run outcomes than perpetual regulation of access. However, when decisions that affect innovation are influenced by political rather than market pressures, efficient innovation can be delayed.

Despite this, central to the federal government's tender is the requirement that the winning bidder supply wholesale broadband access to the NBN at a nationally uniform price to all comers. Yet, both open access, which has been rejected by the FCC (2004, paragraph 9)[21] and uniform pricing (see section 4.1 below) are likely to distort economic efficiency. Indeed, Schwartz (2008) and Nuechterlein and Weiser (2007) have grave doubts about the value of future access regulation in telecommunications. Further, access regulation, which is intended to promote efficient competition, seems particularly unnecessary given existing (see section 2 above) and developing (for example, see Vodafone, 2008a, page 11[22]) facility-based competition, and the protections of Part IV of the TPA. Indeed, as access regulation likely discourages facility-based competition (see the immediately preceding and section 2 above), it may unnecessarily postpone competitive entry and create or perpetuate (rather than help control) market power.

If regulating access is likely to be costly, postponing regulation is relatively cheap, because it preserves substantial option value as compared with regulating early. Postponement avoids distorting initial investments and market developments, which may include competition from unexpected quarters (Kennard, 1999[23]). Moreover, regulation can be introduced at a later date should market outcomes demand it, though, to avoid unnecessary regulatory risk, the process and point in time for regulatory review should be specified in advance. This maintains the option to regulate, but provides an opportunity for market-based solutions (see, for example, Nuechterlein and Weiser, 2007, 428).

In contrast, regulation once established, cannot be easily unwound, since a range of parties come to rely on it and on the rents it invariably creates (in telecommunications see Farrell, 1997;[24] more broadly see Irwin, 1996; Bhagwati, 2005, page 27). To use Schattschneider's famous terms, "new policies", such as mandating access to an NBN, "create a new politics" (Schattschneider (1935) 1974, page 288) which once unleashed is not readily reversed.

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[21] The FCC (2004, paragraph 14) does require, where copper wire previously existed, that the incumbent local exchange carrier provides access to a voice grade, that is, 64 kb/s, access line.

[22] The mobile 4G standard may offer downstream speeds of 100 Mb/s (Vodafone, 2008a). Data over Cable Service Interface Specification (DOCSIS) 3.0 standard allows HFC cable downstream speeds of 200 Mb/s and upstream speeds of 120 Mb/s (http://www.broadbandtvnews.com/archive_uk/151206.html, viewed 9 June 2007).

[23] Kennard was the then chairman of the FCC. He said, in part:

> The quest for openness in the Internet is in line with the history of this medium's remarkable development. Indeed, the Internet's open protocols as well as FCC decisions not to regulate the Internet and to open up access to the phone network are at the heart of the network's growth. E-mail, the Web and Internet radio are only some of the applications that have been developed and deployed in this open environment.
>
> What we need to remember now is that no one could have predicted these innovations. We cannot regulate against problems that have yet to materialize in a market that has yet to develop.
>
> … the FCC has decided not to intervene in this nascent broadband market. In doing so, we are following advice as old as Western civilization itself: First, do no harm—a high-tech Hippocratic Oath.

[24] Farrell was the then Chief Economist at the FCC. Among other observations, he notes:

> one serious barrier to deregulation will be the culture of entitlement to broad subsidies that encrusts our telecommunications policy. It will therefore be crucial to reduce the scope of that culture and those subsidies. One likely strategy may be to start by deregulating "new" services, to wall them off from the culture of entitlement. Again, proper consideration of long-run effects may imply a rule that would seem somewhat "too deregulatory" when examined narrowly in any particular application.

Further, current evidence both suggests access regulation postpones NGN deployment (see section 2.3 above), and forbearance encourages it. In particular, the FCC does not regulate access on new high-speed broadband networks and overbuild is increasingly common in the US. The US's two largest carriers presently supply over 2.5 million US customers on fibre overbuild against established cable companies (AT&T, 2008; Verizon, 2008). Similarly, wireless investment, which is relatively unregulated, continues apace in Australia (Foo, 2008; Vodafone, 2008a) and across the world. As Nuechterlein and Weiser (2007, page 29) say of the US, "The ultimate aspiration of telecommunications policy is to do for the telecommunications industry *generally* what the FCC's deregulatory policies have helped do for the wireless sector *specifically*." (Emphasis in the original.)

In summary, facility-based competition is presently broad, but clearly distorted and constrained by existing regulation and expectations of more of the same. At the same time, no market failure has yet been identified in the context of Australian NGN deployment. These two facts strongly suggest NGN regulation is not merely uncalled for, but can be expected to harm economic efficiency. However, the case against NGN regulation is much stronger than this. Substantial inefficiencies are the most likely outcome of regulating new investments in new technologies, *especially before they have been rolled out*. Rather, in a dynamic market like telecommunications it is far wiser to stand aside for a period of years to allow market forces to work, including by inciting 'investment races' for first mover advantages.[25] Per Schwartz (2008, page 442, citing with approval, Nuechterlein and Weiser, 2007):

> *[M]onopoly is rare in today's telecom industry – most segments exhibit significant competition or plausible prospects. Before tagging something as an enduring bottleneck worthy of intervention, market forces should be given some time to try to erode the market power… The prospects that future access regulation in telecommunications would be significantly more efficient [than past attempts] are undercut by the rapid change and complexity of this industry.*

3.2. VERTICAL SUPPLY CHAINS AND ACCESS REGULATION

The tender process requires bidders to provide open access to the NBN at uniform prices. This is intended to facilitate downstream entry, and though such measures are distorting, it is presumably the governments' belief that the resulting competition can bring greater benefits than these costs. A range of regulatory costs that arise under an access regime were outlined in the preceding sections. This section focuses on another set of costs that arise from regulating access when sunk investments must be made up- and downstream, up- and downstream operations are highly interdependent, and it is difficult to identify whether up- or downstream operations have been effectively carried out. In such complex environments, it is unlikely that the regulatory environment can be appropriately attuned to the interaction of firms at different layers of the resulting vertical supply chain. Worse, access regulation creates fundament uncertainty as to investors' property rights, and this greatly increases the difficulty of writing efficient contracts (Coase, 1960). Consequently, the regulation of NBN delivery is again likely to be distorting, harming consumers and economic growth.

[25] As with patents, such investment races may well involve an element of duplication, and hence of static productive inefficiency compared to the omniscient social planner optimum. However, the gains in dynamic efficiency are likely to significantly outweigh any losses from those static inefficiencies.

As discussed in Section 2.2 above, both up- and downstream undertakings involve substantial sunk investments. It is worth re-emphasising that in the case of downstream demand development, the required network and product development, as well as advertising and marketing investments, are substantial and sunk. In addition, the expected profitability of an NBN, both up- and downstream, is highly dependent on:

- the wholesale or upstream provider's effectiveness in providing bandwidth, reliability, coverage and data streams with specific qualities-of-service (for example, as related to latency, jitter and prioritisation); and
- the extent to which retail firms develop downstream demand, notably by developing and promoting new services.[26]

Such interdependencies, coupled with the high risks and uncertainties associated with broadband deployment, especially when large investments must be sunk both up- and downstream, create substantial difficulties in writing and enforcing contracts between up- and downstream firms. Further, if it is difficult for firms, such a network provider and (by definition, separately owned) access seekers, to obtain optimal outcomes over the vertical supply chain, it is even more difficult to identify efficient access regulation. On top of this, access regulation makes the problem worse by reducing firms' ability to define contracts that determine vertical relationships, most importantly by muddying existing property rights.[27] Three sources of difficulty stand out:

- First, firms have an incentive to get another party to make an investment that will benefit them, and then free ride on the resulting benefits. This creates contractual complexities, and in some circumstances can create efficiency problems.

  The benefits of any particular investment in the NBN and market development at a generally accrue up- and downstream. If the parties that benefit are separately owned, then each has an incentive to try to reduce the amount they pay for the investment, hoping that other parties can be brought to meet the difference.

  With only a few and especially relatively large and known parties, the desire to free ride may be overcome through negotiations (that is, the cost of bringing the relevant parties together and of the subsequent negotiations is likely to be less than the expected losses that free riding would engender—Coase, 1960—but see the third dot point below). However, the incentive to free ride rises with the number of actual and potential benefitting access seekers.

  Smaller players' incentives to free ride are strengthened to the extent that there is a single player that may be willing to unilaterally undertake, though typically not to the optimal extent, the desired investment. A single firm is more likely to undertake unilateral investment if it is large and/or vertically integrated (such as Telstra, vertically integrated with BigPond). This is so respectively because fewer benefits are external to the larger firm, and vertical integration facilitates up- and downstream coordination.

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[26] A fully vertically integrated NBN provider would also be very likely to engage in retail demand development, but this may also be true of an NBN provider that only wholesales, as is common for many manufacturing products.

[27] Put in the terms introduced by Calabresi and Melamed (1972) imposing an access regime effectively converts an asset from being covered by a property rule, that is, a rule which allocates to one party the right to prevent another party from using the asset without its consent, into coverage by a "liability rule", which allows one party to inflict harm on another in exchange for a compensating payment.

Despite this, a larger and/or vertically integrated firm would not in general make optimal investments. Rather, it would only engage in efficient outlays if it expects to recover the costs of doing so, including appropriate compensation for risk. As already discussed, access regulation is unlikely to provide efficient investment incentives (overly strict retail price regulation would have the same effect). Here, however, it worth specifically noting that access seekers can influence wholesale prices, for example, through regulatory and political processes. This concern is especially sharp if access seekers' influence can be exercised after the necessary sunk investments have been made. In that case, existing access seekers can try to induce investment (including through political compulsion), and then reduce access prices *ex post*.[28] Further, even if initial arrangements are entered into without any intention to engage in subsequent chiselling, access seekers, including those who did not exist at the time of the original arrangement, have strong *ex post* incentives to obtain more favourable terms and conditions of access.

As previously discussed, to be efficient access regulation must account for this. For example, the network provider's vulnerability to such expropriation can be reduced (but not eliminated) to the extent that binding regulatory commitments to an *ex ante* pricing arrangement provide appropriate expected returns. However, the problem is much deeper than this. Access regulation does not merely provide a means for chiselling, but also raises the transactions costs of negotiation by creating fundamental uncertainty about the network provider's property rights. Access regulation determines how the investor can use its property. Thus, to the extent that the network provider or access seekers can influence wholesale prices, *they can change property rights*, and they may be able to do so after the NBN investments have been sunk. The result is deep uncertainty as to existing property rights, which makes negotiating to avoid free riding considerably more difficult. This is will lead to highly inefficient outcomes compared with a situation where property rights are well defined (Coase, 1960).

- Second, up- and/or downstream sunk investments make contracting difficult and can have important negative efficiency consequences when these investments are only useful to the upstream network provider and a particular, but separately owned, downstream retailer. Such "relationship specific" investments create the possibility that one firm can hold the other up (Williamson, 1979). That is, once one party sinks a relationship specific investment it becomes vulnerable to the other party seeking to renegotiate the arrangements between them so as to claim the quasi-rents necessary to fund that investment.

[28] Access seekers can also engage in *ex ante* chiselling of this kind. Reverse chiselling is less likely. The federal government's bidding process constrains the network investor's capacity to overprice *ex ante*. Similarly, the regulated access price (determined in the tender) coupled with *ex post* competition (given the NBN cost structure and the imposition of geographically uniform caps—see section 4 below) prevents the network provider from obtaining monopoly profits *ex post*.

Some incremental sunk investments (as distinguished from the initial investment in the NBN) are likely to be relationship specific as the NBN allows for substantial downstream differentiation, both in terms of delivery and products. For example, a downstream firm may wish to sink costs to develop a differentiated service that they expect to allow high margins, but requires upstream sunk network investments specific to that service. Similarly, a downstream firm wish to sink investments that will make it more capable than others in exploiting the downstream market, perhaps because it is expects to be more efficient or to provide high value differentiated services. As a consequence, that firm may expect all or any of greater penetration, greater market share and higher per line margins, and these call for sunk upstream investments that are only justified given its downstream plans.[29]

Vertical relationships between firms with relationship specific assets would be probable even if access were not forced. This is because the network provider would be unlikely to achieve efficient levels of product differentiation on its own, and would seek downstream partners to maximise network usage. However, access regulation makes it less likely that efficient negotiations will occur, because, as before, it creates uncertainty as how the network provider can use its property, and hence makes it more costly for the parties to come to efficient agreements. For example under what circumstances is a network provider able to reject a request from a (downstream) access seeker that wishes to supply a differentiated retail service *that requires specific investments upstream*?

- Third, coordination costs that arise between the network provider and access seekers are likely to be high when the required investments are for new, relatively unknown, services and/or if long-term commitments are required. This is likely the case in NGN supply.

[29] Davis and Williams (2008, page 5) suggest local loops and other network assets cannot "be considered relationship specific" since "in many cases they could readily be supplied to other firms [and t]hat should significantly reduce the possibility of investment hold-up." Yet, as noted, asset specificity is likely at the margins of coverage, and especially quality and product expansion. Moreover, these margins are critical for efficient network deployment and use. At the same time, the free-rider problem, outlined in the preceding dot point, arises for the substantial proportion of the basic network that will likely be used by many access seekers. Davis and Williams also seem to assume that physical specificity is the only form asset specificity takes, which is incorrect. Asset specificity arises from the ability of two parties to secure greater joint returns from using a common set of sunk assets than would be obtained in the next best alternative, that is, from some alternative combination of parties. That gives rise to a quasi-rent that can be shared between the parties and which each party would lose absent access to the other. While physical constraints on profitable redeployment are one reason that may be so, they are far from being the sole such reason. For example, if Telstra invests in fibre loops in the expectation of sharing in the revenues that will be generated by the unique applications owned by a third party, and would be unable to recover its costs, once they were sunk, should it not have access to that application, then it is vulnerable to hold-up by that party, even though there are no physical features of the loop that prevent its redeployment to less valuable alternative applications.

Writing contracts that are appropriate for all relevant, and in many cases unknown, contingencies, is again difficult, and many cases leads to vertical integration as a means of avoiding these problems (Joskow, 1985). As previously noted, NBN supply without access regulation would likely still result in contracts between vertically separated firms, as well as some vertical integration. However, access regulation greatly complicates the problem of identifying when vertical separation is efficient, and of writing contracts for those cases, because of the way it muddies the property rights of the network provider. In particular, the potential for, or presence of, access regulation creates uncertainty as to the network provider's rights, notably its rights to decide when and how it would grant third party access to its infrastructure. Neither the network provider, nor access seekers, nor even the regulator, can define, with the same clarity as provided by the body of property law, the terms and conditions of future access. Further, the regulator cannot avoid this problem by determining (stating) the terms and conditions of access, since the enforcement of those terms and conditions is not as well defined as the parties' rights under property law. This problem is made worse if, as is often the case, the regulator polices the terms and conditions it sets, as it may be tempted to change those *ex post*, which in turn reduces its incentives to provide, as much as possible, the parties with clarity to start with.

In summary, regulating access involves writing contracts where, in some cases, private parties fear to tread, and by so doing, can make it harder for those parties that wish to write their own contracts to successfully do so.

4. PROTECTION FROM THE TAKING OF MONOPOLY PROFITS

The previous two sections argued respectively that commitment to minimal access regulation is necessary to provide efficient incentives for NBN investments, and access regulation is, in any case, likely to be highly distorting. This raises the question of whether a NBN provider, if it were to face very light-handed regulation, would have substantial market power that would be used to harm consumers and/or economic efficiency. This section accepts, for argument's sake, that some regulation should be imposed to reduce distortions associate with pricing to claim monopoly rents, and considers what kind of regulation would achieve that objective at least economic cost. Section 4.1 explains why restrictions requiring uniform pricing may be especially misplaced, while section 4.2 argues that if *ex ante* regulation is necessary then a *wholesale* price cap is likely to minimise regulatory harm. Section 4.3 concludes that the terms of the government's tender, which impose geographically uniform and open access charges, as well as capping existing wholesale prices at present rates, that is, anchor pricing, would constrain monopoly pricing, even if either policy was unlikely to be optimal.

4.1. A UNIFORM PRICING RULE IS MISPLACED

The debate about access pricing is sometimes characterised as a choice between short run allocative efficiency (where the short run may be many years long) and long run dynamic efficiency.[30] On the one hand, it is said that regulating access to existing sunk assets ensures efficient use of those assets in the short run, but distorts long run investment

[30] We are of the view that the short run allocative benefits are overstated, and the main, if not sole, attraction of access regulation is that it ensures an adequate sharing of surplus between the network provider and consumers. However, it often does so at a cost that exceeds the benefit.

decisions and hence dynamic efficiency. On the other hand, avoiding regulation allows for dynamic efficiency, but may harm consumers and short run allocative efficiency.

Section 2 above made the point that when substantial new and sunk investments are called for there may be no short run allocative gains from access regulation, but only dynamic efficiency losses (because inefficiently too little investment would be called forth). This section puts aside whether access regulation would harm investment incentives, taking it as given that the necessary investment in the NBN is undertaken. In that context, the section makes the point that in the supply of NGN services, the imposition of a uniform pricing requirement is unlikely to involve a trade-off between allocative and dynamic efficiency, but rather may sacrifice both.[31]

This possibility emerges from the patent literature where a similar debate about allocative versus dynamic efficiency occurs: patents are said to create short run allocative harm, because they lead to monopoly pricing, but provide effective incentives for long run innovation, bringing much valued dynamic efficiency. However, Hausman and Mackie-Mason (1988) show that this trade-off need not apply when price discrimination is possible (see also Bowman, 1973, pages 56, 112, whom Hausman and Mackie-Mason cite; in the literature on telecommunications, see Schwartz, 2008, page 423). This is especially so where price discrimination allows new services to emerge that otherwise would not be provided, and, in any case, is generally so to the extent that marginal costs are likely to be falling, which almost certainly characterises new retail broadband services. Similarly, it would allow efficient risk sharing between firms with different appetites for risk, rather than forcing a one-size-fits-all solution.

The allocative versus dynamic efficiency trade-off arises due to concerns that short run monopoly pricing (assuming it is indeed efficient for a NBN provider to not take account of the long run growth implications of its short run prices) can inefficiently reduce demand. However, this cannot justify imposing a uniform pricing constraint: when price discrimination is possible, output, and more importantly, economic efficiency, may both rise.

Efficiency benefits from price discrimination are especially likely if price discrimination allows new service development that otherwise would not occur, since this leads to first order efficiency gains that would be lost under uniform pricing. Moreover, new service development is particularly likely in the present case, since NGN rollout is virtually certain to lead to the development of many new retail services. As a result, the likelihood that some service's viability would depend on price discrimination is higher than were fewer new services probable.

If marginal costs are declining, then, even when price discrimination is not necessary to bring a new service to market, price discrimination is also likely to increase economic efficiency. Declining marginal costs can be expected for services that are reliant on a NGN for two reasons:

- There are likely to be substantial economies of scale in retail broadband services, and most especially in the early days of rollout, when initial volumes are small.

[31] The government's NBN tender requires uniform geographic prices with no variation between access seekers. It is not clear whether price variation across applications would be allowed, and the tender may allow prices to vary with purchased volumes. The analysis in this section applies to any restriction the tender imposes on the NBN provider's capacity to engage price discrimination.

- When new products are rolled out, it is inappropriate to think of technology as being fixed. Rather, substantial cost reductions are typically gained from learning by doing. The result is that, even ignoring scale effects, marginal costs decline over time.

In summary, forcing uniform wholesale prices on NBN services is inappropriate given many, if not all, of the derived retail services are likely to be new. Rather, the NBN provider faces good incentives to efficiently price discriminate, that is, so as to ensure maximal use of its network (this point is reinforced in section 5.1 below).

Of course, the extent to which this issue arises in the NBN will depend on the exact form of any uniform pricing obligation and its interpretation. This is an issue that greatly vexed regulation under the Telecommunications Act, 1991 (the predecessor to the current regime), which had a range of restrictions on price discrimination. To the extent to which government wishes to see some degree of uniformity, probably the 'least harm' approach involves merely requiring that there be a uniform price on offer, that uniform offer then coexisting with offers that involve greater or lesser price discrimination. However, difficulties can arise if the uniform offer must be 'reasonably attractive' or 'reasonably available', in which case it can act as a *de facto* constraint on the scope for potentially efficient price discrimination.

4.2. *EX ANTE* REGULATION

Despite all of the preceding some readers may remain unconvinced that a NBN provider should not face some form of regulation on its capacity to set monopoly prices. This section argues that if regulation is to be implemented, then a wholesale pricing cap will tend to minimise regulatory harm. Caps have a range of benefits, notably because they provide:

- the firm with flexibility to deal with market complexities that are likely beyond the regulator's capacity to deal appropriately with;
- good incentives for cost reductions; and
- relative simplicity.

Moreover, the well-known difficulties of price caps are not as problematic for wholesale broadband services as for other industries.

Recognising the harmful effects of regulation, especially dynamically, the modern view is that regulation should:

- be a last resort (Farrell, 1997; Neuchterlein and Weiser, 2007, pages 428-429);
- be as light-handed as possible (Farrell, 1997), which in part can be achieved by shifting regulation to the wholesale layer (Kennet and Ralph, 2007; Vogelsang, 2002), because, among other things, this narrows the regulatory footprint and allows risk-bearing contracts that would be difficult to impose on small end-users, while simultaneously protecting end-users through the provision of competition; and
- encourage competition so that regulation eventually may be withdrawn (Farrell, 1997; Vogelsang, 2002).

In this light, wholesale price caps are attractive. In contrast to rate-of-return regulation, price caps:

- provide efficient incentives to innovate so as to reduce costs. For example, Gasmi *et al.* (2002, pages 59-60) find that despite being simpler than other mechanisms, price caps provide a relatively high degree of efficiency (Table 7.12, page 124), but in so doing must grant firms material profits (Table 7.11, page 122); see also Vogelsang (2002, pages 8, 10);
- allow the basket of services covered to be readily rolled back as competition develops by reducing the prices covered by the cap (Vogelsang, 2002, pages 23-24); and
- provide appropriate flexibility when a firm is regulated in some sectors and faces competition in others (Gasmi *et al*, 2002, Chapter 9), as will be the case for an NBN provider.

Caps can also be readily applied to wholesale prices only, and this is our recommendation, consistent with minimising regulation in favour of competition (see also Vogelsang, 2002, pages 23-24). This, for example, has the attraction of avoiding direct distortion of what is likely to be a dynamic and competitive retail market.

Price caps typically apply to a basket of services, thereby providing the network owner with flexibility to respond to demand, that is, to rebalance (Vogelsang, 2002, page 8), as well as to price allowing for technological change, competitive developments (Vogelsang, 2002, pages 14, 16) and demand interdependencies (because wholesale services are typically substitutes one for another). This flexibility is arguably particularly important in the case of the NBN, where demand interdependencies and technological and competitive changes are closely linked and can be rapid and extensive. (While greater flexibility arguably provides greater capacity to engage in anticompetitive pricing behaviour, that can and should be dealt with *ex post* by the application of competition law.)

In contrast to capping the prices of a service basket, the ACCC's approach to date has been to set individual caps so that, at least putatively, the price of each declared input is expected to recover the ACCC's estimate of its incremental costs. Such individual caps provide good incentives for reducing costs (Vogelsang, 2002, pages 8-9), but it is unlikely that a regulator could identify the efficient set of relative prices such an approach requires. This is important given that:

- most wholesale services are substitutes one for another;
- in any case have cross-price effects; and
- estimating incremental costs of individual services is not only considerably harder than estimating cost for the aggregation of regulated services, but raises difficult issues about the recovery of shared costs.

In contrast, price capped baskets allow the firm to set individual prices to maximise revenues subject to the cap, which ensures that monopoly profits are constrained.

While price caps have many attractions, they also have shortcomings. For example, to ensure fully effective incentives for cost reduction, it must be credible that the price cap will be maintained for a substantial period of time. This requires that the cap's rules, set *ex ante*,

are sufficiently keyed to exogenous changes that over the regulatory period the firm is unlikely to be forced to incur losses, or allowed to gain extraordinary profits (taking account of risks). Otherwise the cap may be reneged (Vogelsang, 2002, page 8). Thus, caps often have to be generous, especially when costs are highly uncertain (at least to the regulator), to assure the ongoing viability of the firm (Gasmi *et al*, 2002, pages 5, 52, 59-62; Table 7.11, page 122).[32] While this may be a fatal problem if the industry could face sustained input cost inflation that exceeds productivity, this is relatively improbable in telecommunications (Vogelsang, 2002, pages 8-9). Even so, the difficulty of setting a cap that would hold prices close to efficient costs, without overstepping that mark, remains. The more uncertain the regulator is as to costs, the greater the expected profits properly and efficiently granted by the optimal cap. To the extent to which regulators prove reluctant to grant those profits, exactly the same issues of regulatory opportunism and *de facto* expropriation can occur under a price cap as have characterised the Australian regulatory arrangements to date.

Caps can also require quality monitoring, since profit may be increased by reducing quality as well as costs. That being said, two reinforcing factors likely offset incentives to reduce quality: competition (Vogelsang, 2002, page 11) and the need to develop broad network use so as to recover the substantial fixed costs of the NBN. As discussed in the next section, a requirement that wholesale and retail prices be geographically averaged creates strong pressures to maintain both wholesale and retail quality. In low cost areas, full facility competition can readily undercut a service with a geographically averaged but otherwise efficiently quality-adjusted price. Any inefficient deterioration in service quality would only increase the extent of facility competition, and reduce the prospects of recovering the NBN's substantial investment. Moreover, the commercial imperative to migrate customers to higher speed services, and to encourage the growth of applications that make good use of the NGAN's distinctive capabilities, further undercut incentives for the network owner to degrade quality.

4.3. THE CONSTRAINTS OF UNIFORM AND ANCHOR PRICING

The government's tender imposes a uniform pricing requirement. In addition, Telstra has suggested the application of anchor prices, where the prices of a set of existing wholesale services are capped at present rates (a CPI-CPI cap). Each of these constraints on its own, whether ultimately economically efficient or not, is likely to largely prevent the NBN provider from claiming material monopoly rents, assuming it would otherwise be able to do this.

Geographic averaging means that, in retail markets, the NBN provider will face effective competition from facility-based suppliers, such as those identified in section 2.1 above. This is because to recover costs, the NBN provider must set wholesale prices that, in low cost areas, exceed not merely average short run marginal costs, but average long run costs. Moreover, it must do so over the long term. Such positive margins in low cost areas are likely to encourage expansion of existing competitive networks and new network construction.

[32] In the context of oligopolists that face varying demand, price caps that exceed long run marginal cost can still bind and so increase output and hence economic efficiency and investment relative to no regulation (Buehler *et al*, 2008). The model is one in which firms choose capacity and output levels, each with a constant marginal cost. If the price cap is not binding, investment is not altered. If prices are capped below long run marginal costs, then insufficient capacity is built and in the peak period demand exceeds supply (the cap prevents prices from clearing the market). If the price cap binds, but prices can exceed long run marginal cost, then output and investment are greater than if there were no cap, but prices that clear the market are allowed.

Consequently, to maintain its share in low cost areas, the NBN provider will have strong incentives to:

- keep network costs as low as possible, while offering service quality and extending service breadth; and
- offer long-term and other tailored contracts that signal efficient costs, thereby avoiding inefficient bypass (which destroys surplus that could be shared between the NBN provider and potential facility-based entrants).

As for anchor pricing, it involves committing to fixing price levels for legacy services, or at least for key services among those. It is in some respects similar to the 'reference service' concept used in Australian gas transmission regulation, which requires regulated entities to define the price of a service – the 'reference service' – for which there is broad demand. Once that price is set, the regulated entities have flexibility in the setting of prices for other, generally substitutable, services, since the price for the reference service acts as a constraint on how prices for those other services are set. In the case of the NBN, the anchor price would be set for the reference services in the legacy network, that is, the core PSTN services and the legacy broadband access services.

Anchor pricing leads to competition from the installed customer-base that will force the NBN provider to competitively price newer services so as to ensure maximal network use. If the NBN provider is to recoup its costs, then it must price new services so they are competitive with anchor services (Ergas, 2008a; 2008c), otherwise access seekers would thwart service expansion by simply continuing to supply legacy services at low prices.

At the same time, anchor pricing guarantees that migration to a NGN does not make access seekers and the installed base of retail customers currently supplied either directly by Telstra or indirectly by access seekers, worse off. This is quite simply because anchor prices ensure customers retain the options they currently have; as a result, for the new services to be viable, they must increase the consumer surplus consumers obtain. In that sense, properly specified anchor prices ensure that the conditions for welfare improvement are met: the incremental costs associated with providing the new services will only be incurred if they are exceeded by incremental benefits, with consumer surplus being no smaller than in the status quo.

Moreover, anchor prices provide a benchmark against which Pareto improving commercial contracts can be negotiated (Graham and Vernon, 1991). If more complex contracts are efficient, that is, allow gains from trade that exceed negotiation costs, then these are likely to realised without further regulatory (and likely distorting) intervention. For example, the NBN provider must make long-term cost commitments, providing it with incentives to offer users, notably access seekers, commercial contracts with discounts for long-term commitments of specific volumes. Such prices would make it easier to allocate the costs of long-lived assets across their lives and shared infrastructure, thereby avoiding arbitrary cost allocations to different time periods or services (Kennet and Ralph, 2007, pages 137-140). This not only ensures a greater likelihood of efficient cost recovery on the part of the network provider, but also is likely to provide access seekers with more efficient build/buy and network usage signals (since their marginal costs are more likely to emulate actual marginal costs, rather than average costs). Indeed, the more efficient such prices are, the greater the gains from trade that can be claimed from their development.

The network provider's incentives to offer competitive commercial contracts are similarly sharpened by the NBN's high fixed and low marginal costs. Under such a cost structure, the network provider's profits are maximised by substantial network use, which is more likely to be obtained if prices signal the marginal costs of supply, rather than, for example, long run incremental costs averaged over both time and volumes. Thus, again the network provider has good incentives to seek out more efficient access prices than those that can be expressed in spot prices.

Anchor pricing has a further advantage of being relatively simple to implement—the regulatory review, at its simplest, could accept existing spot prices, given these were previously determined by regulation. However, in Australia, as there are good reasons to think existing prices may be set too low or otherwise sub-optimally (see section 2.3.1 above), some review would be called for. Consideration of anchor spot prices is also likely to be easier than review of much more complex tailored contracts, though it might be easier still to set long run prices and allow the market to develop spot prices (again see Kennet and Ralph, 2007).

In conclusion, while uniform and anchor pricing may not be ideal pricing strategies they do have some capacity to reduce the NBN provider's ability, assuming it exists, to set monopoly prices. A benefit of anchor pricing is that it helps ensure that any moves from the *status quo* are a welfare improvement, and does not invite additional regulatory error in the setting of the anchor price (if the existing prices are simply retained and serve as the anchor). In contrast, while imposing price caps with long-term reviews has the scope to be superior in welfare terms, it involves additional regulation at the outset of the NBN (as the price caps must be set and at some point reset). This may inject new regulatory error, undermining the efficiency and viability of the NBN either from the start or at least at the time of reset. As a result, the best approach may seem to be to rely on anchor pricing, and have no other form of price regulation.

A potential concern with that approach is that the anchor may be of fading efficacy over time. For example, the legacy broadband access services (offered at speeds of up to say 8 Mbps) would certainly be an effective constraint in the near term over broadband pricing for new NBN access services, but might no longer be so should speeds in excess of 12 to 15 Mbps become the prerequisites for access to a broad range of applications. However, it seems reasonable to suggest that that situation corresponds precisely to the 'upside' that could justify commercial investment in an NBN, and that to regulate pricing in that 'upside' merely removes or blunts the incentive required to motivate the investment in the first place – all the more so as there is no corresponding floor to the losses the network owner would incur in the 'downside'. While it is true that strong demand for very high speeds would allow the network builder to set higher charges for those speeds than could be sustained in a low demand environment, it is not obvious why those higher charges (which reflect the greater value consumers place on the services) should be prohibited, especially if there has been a more or less competitive tender to build the network in the first place.

This is not to suggest that as a matter of commercial reality, anchor pricing alone can guarantee that prices are never set on a basis that allow supra-normal earnings. However, given cost and demand uncertainty and asymmetric information, any efficient price cap must also allow the firm some scope to secure such earnings (so that the only practicable alternative to anchor pricing does not clearly perform better in that respect). Moreover, any social losses from allowing such earnings (which are themselves only a possibility, as it is far

from certain that high demand states of the world will eventuate) will likely be small if the network operator is allowed to price discriminate and faces some degree of constraint from alternative (possibly wireless or HFC-based) networks.

All of that said, it may be that the government requires a higher degree of protection from too-high pricing than could be given by a once-and-for-all anchor, given the concerns noted above about the likely declining effectiveness of such an anchor over time. To that extent, it may be worth considering some form of 'floating anchor', in which the anchor service, and its obligations, move in line with changes in the composition of market demand. Such a 'floating anchor' might be based on the concept of a 'reference service' used in Australian gas pipeline regulation. A possible approach is as follows:

1. As under the Gas Code, a network operator must nominate at least one reference service;

2. A reference service must account for a substantial share of demand;

3. The price cap for a reference service is deemed to be set at CPI-CPI, unless an application is made to the regulator and accepted for it to be set on another basis;

4. The initial reference services are the core legacy services (PSTN fixed network access, 1.5~2 Mbps WDSL);

5. Once a service accounts for 40 per cent of demand by volume, it is deemed to be a reference service, unless the operator nominates an alternative service (see below) and that nomination is accepted;

6. If the network operator nominates a reference service, the regulator must accept that nomination unless it would be unreasonable to do so, where unreasonable means that the nomination would result in a situation where the interests of end-users would be harmed as a consequence of price increases. If the regulator is offered an undertaking that prevents such price increases, the regulator must accept it unless the undertaking would more likely than not be ineffective;

7. Once the regulator has accepted a nomination for an anchor service, prior nominations become void and no other services are anchor services during the period of the nomination; and

8. The network operator must offer long term contracts for all anchor services it offers, and must negotiate over the terms and conditions of those long term contracts in good faith.

In short, as was stressed in Ergas (2004), transition to an NBN offers scope for far-reaching simplification of the regulatory arrangements, shrinking the set of regulated wholesale services to at most a very few services that provide transparent IP transport from customer premises to points of interconnection. Anchor pricing provides an equally simple way of controlling the charges that a network operator can set for those services, with the anchor prices:

(a) Ensuring consumers are no worse off, and potentially significantly better off, from the move to an NBN (assuming service quality levels are also no worse than in the *status quo*);

(b) Creating scope for efficiency-enhancing contracts that yield gains from trade relative to the anchor prices;

(c) Constraining the network builder's pricing discretion, without removing the ability for it to secure higher prices should consumer demand for new services prove to be strong.

5. NON-DISCRIMINATORY ACCESS

Vertical discrimination it typically thought of as arising when a vertically integrated carrier supplies a poorer wholesale service to its downstream rivals than the service it supplies to itself. As a result, vertical integration is widely perceived as opening the door to vertical discrimination. However, incentives to vertically discriminate exist even when the upstream firm has no downstream operations. There is little to prevent an upstream firm from collaborating with a downstream firm, perhaps even only implicitly, to effect profitable vertical discrimination. Indeed, the Australian Competition Tribunal found such behaviour in the relations between Qantas and Sydney Airport Corporation (see *Virgin Blue Airlines Pty Limited* [2005] ACompT 5). Consequently, varying degrees of vertical separation are unlikely to make vertical discrimination much more difficult, *and if it is made more difficult this will also harm efficiency-enhancing collaboration*. Yet, the presumption is that commercially chosen vertical integration is beneficial (Lafontaine and Slade, 2007; Yarrow, 2008, section 9; Cave, 2008, section 1). Moreover, there are many circumstances when vertical discrimination is not profitable (Mandy and Sappington, 2007[33]) so protection against it is unnecessary. Thus, imposing separation threatens substantial benefits for uncertain gain. For example, *imposed* separation results in inefficiently low levels of upstream quality when downstream prices are marked-up above costs (as will be the case on NGNs) and efficient nonlinear access prices cannot be determined (as is again the case, since access prices are typically linear, but, in any case, the regulator is highly unlikely to be able to identify efficient nonlinear prices)—Buehler *et al*. (2004) and Ergas (2007). Finally, there is no reason to suspect that competition law remedies are not the most effective means of dealing with such behaviour.

This section does not try to weigh the harms of vertical discrimination against the benefits of vertical economies of scope, or the likely benefits and costs of regulation designed to prevent vertical discrimination, or the relative efficacy of *ex ante* regulation vs *ex post* prosecution of competition law. Instead, it focuses on three propositions:

- in supplying an NBN, a vertically integrated network provider's incentives to discriminate against its downstream rivals are muted as compared with a traditional copper network. In particular, given the extensive network use that downstream product differentiation is likely to imply, and the network provider's need to ensure cost recovery of what is an expensive and sunk asset by extensive use of that asset, such discrimination is likely to be counterproductive (see section 5.1);

[33] Mandy and Sappington (2007) distinguish between cost-raising (for example, forcing the use of more expensive equipment) and demand-reducing vertical discrimination (which, for example, lowers the quality of its rivals' services). They show that when competition is Bertrand (as is arguably the case in telecommunications, especially over the longer term), the likelihood that demand-reducing vertical discrimination is profitable is small. As for cost-raising discrimination, it seems unlikely, given that the NBN allows standard interfaces for interconnection and in any event, involves far less reliance by third parties on the incumbent's infrastructure and operational support systems than occurs in the current network.

- while *ex ante* imputation tests can be applied to prevent price squeezes, these have significant efficiency costs, and much more so in the case of broadband, as compared with traditional telephony services (section 5.2);
- a more generous price cap will reduce incentives for non-price discrimination (section 5.3).

5.1. INCENTIVES TO DISCRIMINATE

An NBN has two important characteristics relative to traditional networks that reduce the NBN provider's incentive to engage in vertical discrimination: both the ratio of shared to marginal costs and retail product differentiation are likely to be higher. In what follows subsection 5.1.1 explains what drives the profitability of vertical discrimination, while subsection 5.1.2 shows how the nature of NGNs lowers the profitability of vertical discrimination.

5.1.1. The profitability of vertical discrimination

This section demonstrates that the profitability of vertical discrimination rises with:

- the ratio of wholesale to retail margins; and
- what is called the diversion ratio,[34] that is, given a particular act of vertical discrimination, the ratio of the retail revenues the network provider gains to the total retail revenues that the vertical discrimination causes its downstream rivals to lose (Biglaiser and DeGraba, 2001).

Consider first an extreme case where the ratio of wholesale to retail margins is negative, so access prices fail to recover short run costs and all cost recovery occurs in retailing. In that case, a vertically integrated network provider has strong incentives to (1) minimise what it wholesales, since every failed sale is a loss avoided, and (2) maximise what it retails, since this the only way it can recover its costs. As a result, the network provider has strong incentives to vertically discriminate at the wholesale layer. This both reduces wholesaling losses and provides it with a retailing edge.

A similar, but slightly more complex story arises when access prices make a contribution toward sunk costs. In that circumstance, a given act of vertical discrimination, assuming it has an effect, reduces wholesale demand causing a loss of contributions toward sunk costs. This, however, may still be attractive to the vertically integrated network provider if the lost contributions on access sales are more than replaced by retail sale margins. The degree to which this can happen depends on two things, first, the size of the retail margin gained relative to the wholesale margin lost, and, second, the fraction of customers who switch to the vertically integrated network provider relative to those who simply stop consuming (which is essentially the diversion ratio).

When retail supply is differentiated, the diversion ratio of a given form of vertical discrimination is generally less than one, that is, some customers stop consuming altogether, rather than switching to the vertically integrated network provider. For example, if vertical discrimination leads ten customers to quit downstream rivals of the network provider,

[34] The term is borrowed from merger analysis where it refers to the share of total sales lost by one product due to a given price rise that are transferred to a specific other product (see, for example, Werden, 1996).

something less than ten customers, say, eight, switch to the network provider. (Equivalently, if the network provider seeks to retain the 10, it would need to offer lower prices to compensate for the otherwise discouraged customers' lower willingness to pay). Thus, for vertical discrimination to be profitable, the retail margin must exceed the wholesale margin. Continuing with the example, if the margin lost on wholesaling is $1 per customer, the vertically integrated network provider loses $10 in wholesale contributions, but gains a retail margin from eight customers. That gained retail margin must exceed $1.12 (rounding to whole cents) if the vertical discrimination is to be profitable.

The result is that the higher the ratio of the wholesale to the retail margin, and the lower the diversion ratio, the less attractive vertical discrimination becomes.

5.1.2. NGNs reduce the profitability of vertical discrimination

With the factors that drive incentives to vertically discriminate elucidated, it can now be shown how the nature of a NGN makes vertical discrimination less likely. In particular, relative to a traditional network, it is highly probable that on an NGN the ratio of wholesale to retail margins will be higher, while the diversion ratio will be lower, reducing or eliminating the gains from vertical discrimination.

One of the attractions of an NBN is that it will have lower operations and maintenance costs upstream as compared with traditional copper networks. These lower costs are in part obtained by incurring relatively high upfront costs, including by pre-provisioning high capacity fibre optic connections to nodes and high speed line cards at nodes. (The fact that the line cards are pre-provisioned then allows activation to be done entirely remotely, averting the need for a costly field call on the occasion of service activation). Further shifts in the ratio of marginal to fixed costs are obtained as the transition to an all-IP network allows deployment of soft switches, which can handle end-to-end traffic in IP form, and which typically have far greater scale economies (and handle far greater numbers of lines) than conventional circuit-switched systems.

As a result, once fully deployed, the ratio of marginal costs to shared and other costs that do not vary with most output levels will be considerably higher than in existing networks. Consequently, if access prices are to recover upstream costs, then the difference between those prices and short run marginal costs (upstream contribution margins) will have to be higher than they are now. Indeed, such high margins are necessary if investment in the NBN is to be forthcoming. For example, margins will be high relative to today, at least in expectation, if a wholesale price cap is set so as to ensure the regulated firm is willing to make the required investments under the cap.

High access price margins, at a minimum, reduce the prospect that access prices will not cover short run costs, so avoid a situation in which vertical discrimination is virtually guaranteed. More generally, higher margins, holding retail margins constant (but see below) would increase the ratio of wholesale to retail margins relative to those on a traditional network, reducing the attraction of vertical discrimination.

A more basic premise of an NBN is that downstream it will allow a much wider range of services and greater service differentiation. When Optus resells a Telstra service on the existing network, minor differences in price structure and possibly retail service (such as billing) aside, the final product is pretty much the same. Matters are a bit more complex for ULLS, but FTTN is more capable than ULLS, with more scope to alter service quality and features (for example, contention ratios, how much quality of service management there is, and so on). This is all the more so as service providers in an NBN will compete not only in terms of network or service level attributes (such as contention ratios), but also in terms of the range of applications they offer.

Increased service differentiation has two impacts:

- It tends to increase downstream margins. This is because, with product differentiation, consumers pick the service that suits them most, and switching requires choosing something with less attractive attributes and, as a result, firms have somewhat more localised market power than when services are more or less identical.[35]
- It lowers the diversion ratio, again because it makes purchasers less willing to transfer their custom to another firm.

The upshot of higher upstream margins and lower diversion ratios is that the attractiveness to a vertically integrated infrastructure provider of stealing downstream custom is likely to be less with an NBN than with a copper network. This is because while greater downstream differentiation will, in all likelihood, increase downstream margins, this is at least significantly, if not more than, offset by rises in upstream margins, but in any case, downstream differentiation lowers the diversion ratio so these margins are less available to the vertically integrated firm. The result is that the opportunity cost to the vertically integrated firm of selling to downstream rivals is lower (because it cannot independently satisfy retail differentiated downstream demand), which means it has more incentive to sell the downstream rivals access services.[36]

5.2. PRICE SQUEEZES AND IMPUTATION TESTS

A price squeeze is said to occur when a vertically integrated firm that controls supply of an essential upstream input sets up- and downstream prices such that an efficient downstream rival cannot profitably retail (Crocioni and Veljanovski, 2002). Such behaviour is on its face costly to the squeezing firm, since it foregoes more upstream than it gains downstream, and especially so if downstream service is differentiated.[37] However, it may be profitable if the firm expects, because of the harm its actions cause its rivals, to subsequently earn profits that otherwise would not have been available and which more than compensate for the initial

[35] All this means is that suppliers face less than perfectly elastic demand. In economic terms, that amounts to market power, but it is obviously very different from monopoly power, that is, the ability to earn revenues materially in excess of the firm's opportunity costs for a non-transitory period or "to appreciably increase market [as compared with firm-level] prices" (Klein, 1993).

[36] In this respect, Davis and Williams (2008, pages 8 and 11) are wrong to claim that "vertical integration concerns will *only* be lessened with NGNs if the NGN investment is accompanied by much less stringent price regulation." As noted, if access prices do not recover incremental costs, then there is a strong incentive to discriminate. For higher access prices this incentive declines most particularly with the ratio of up- and downstream margins and the diversion ratio.

[37] If it is cheaper to self-supply than to supply third parties, then the margin between the vertically integrated firm's down- and upstream prices may not be sufficient for a rival to compete, but such a rival would not be efficient, that is, would not be a least-cost supplier.

lost profits. If, instead, profit recoupment is not possible, then such behaviour is no different from any other competitive behaviour, which necessarily harms rivals and benefits consumers.

In short, a price squeeze amounts to a form of vertical predation where the below cost price arises because the firm fails to fully reflect its upstream opportunity costs in its downstream prices. Since, much like predation, an anticompetitive price squeeze is only profitable in unlikely circumstances (Crocioni and Veljanovski, 2002, pages 38-42) and difficult to distinguish from pro-competitive behaviour, it can be highly costly to ban it (Carlton, 2008). For example, rather than risk being accused of a squeeze, a supplier of an input may over price its downstream output, or simply refuse to produce the output where there is no duty to supply.[38] This could have particularly adverse consequences if the input was used for many products, not just the one in which there was a squeeze. Consequently, if a squeeze is to be illegal, it should be subject to strict conditions of proof, recognising some illegitimate behaviour would escape prosecution because the cost of this would likely be less than the cost of more stringent price squeeze regulation.

Ex ante policing of price squeezes, that is, pre-emptive monitoring of retail margins without any suggestion that anticompetitive behaviour is taking place, is even more intrusive than applying trade practices remedies and hence has higher direct and indirect costs. Such monitoring requires substantial quantities of confidential data, and extensive modelling. Moreover, the imputation tests, by definition, must be undertaken on an entirely hypothetical basis (since no allegation of a squeeze is actually made). This is contrary to standard competition law practice where context is crucial, that is, the analysis must be grounded in the specific allegations (see, for example, ACCC, 2008, pages 32-3; Miller, 2008, pages 352-353). Not surprisingly, an approach that tests for hypothetical price squeezes readily becomes very broad ranging. For example, Telstra is required to constantly test an enormous range of prices across different customer groups, services and aggregations of the same. Such tests must be relatively shallow analytically, since the costs of engaging in full-blown market analysis of any particular squeeze would be prohibitive and greatly disproportionate to the potential harm. The result is a proliferation of *ex ante* tests, most of which would not pass muster at competition law, but all of which risk chilling efficient and pro-competitive behaviour.

Ex ante tests are also more difficult to implement and a price squeeze is less profitable when services are supplied on an NBN, as compared with a copper network for two reasons:

[38] When faced with a duty to supply, the vertically integrated firm might overprice or exit downstream to avoid legal risk. Exit would be harmful if supplier was more efficient than the other players, or if diversity downstream had a benefit.

- The services sold downstream will be somewhat more differentiated. This will make it more difficult to implement price squeeze tests, as standard tests involve comparing undifferentiated services, and taking service differences into account requires the exercise of substantial discretion. In particular, standard tests assume that retail output by downstream suppliers is a perfect substitute for the vertically integrated firm's retail output, and that the ratio of retail to wholesale services is fixed over all retail services. Thus, if the vertically integrated firm displaces, say, 10 units of a rival's retail services it foregoes 10 wholesale units. In practice, it may displace 10 retail units, and only gain 9, because the vertically integrated firm is not capable of meeting some demand for the downstream firm's differentiated service. Similarly, the vertically integrated firm may displace 10 retail units, but only see wholesale units fall by 9 because the downstream rival may be more efficient in combining downstream output with upstream services (the reverse is also possible). In such an environment, determining whether there is a price squeeze and if so, its impact on the different firms' profits, involves very substantial judgement, and is granting the regulator a great deal of discretion in regulatory proceedings.

- Broadband services are much more likely to involve two paying groups of customers, the traditional content seeker (or downloader), but also the content provider (some of whom may pay, for example, so as to ensure their content reaches the end-user more quickly). Moreover, this relationship is further complicated because many network providers are also content suppliers, having an additional relationship with advertisers. Constructing imputation tests in such two-sided environments will be challenging to say the least.

At the same time, if the wholesale margins required to ensure the required NBN investments are greater than those granted under traditional regulation of copper networks (as argued above), then anticompetitive price squeezes are relatively less profitable. This is because, as before, greater wholesale profits must be given up relative to the retail revenues gained. Hence, there is less reason to be worried that an NBN provider might engage in a price squeeze.

5.3. NON-PRICE DISCRIMINATION

5.3.1. On wholesale contributions and the incentive to engage in vertical sabotage

In regulating access prices, several goals must be met. Efficient investment must be induced, excess profits must be avoided (including by obtaining good estimates of costs) and incentives to vertically discriminate minimised. Recognising these multiple goals strengthens the conclusion that a relatively generous wholesale cap is likely to be efficient.

As noted in section 5.1 above, the greater the wholesale contribution margin the less attractive is vertical discrimination (sabotage) and *vice versa*. It follows that the lower the access price, and also the greater effort taken in policing underlying cost estimates, the greater the vertically integrated firm's incentives to raise its rivals' costs (vertically discriminate), and hence its willingness to both undertake and conceal such activity. In this context, the cross-effects of pursuing one regulatory goal, such as ensuring careful cost auditing, on other regulatory goals, such as preventing vertical discrimination, leads to a recommendation of less rigorous price regulation.

The standard story on vertical discrimination is that whether vertical price discrimination is profitable depends on the specifics of any circumstances (Mandy and Sappington, 2007, section 1, which provides cites to the literature):

- When rivals' costs are raised there is, at any given price, a reduction in output and part of the retail demand shifts toward the vertically integrated firm (some of the retail demand may shift to a third party and some may be lost, as is the case if there is some product differentiation).
- However, this reduction in output also reduces demand for the vertically integrated firm's wholesale services, but in general by more than the gain in retail sales.

The net effect on the vertically integrated firm's profits, assuming wholesale service prices exceed short run marginal costs (that is, make some contribution to total costs), is ambiguous, and so specific analysis is required for each given situation (though, Mandy and Sappington (2007) show that in telecommunications the likelihood that demand-reducing vertical discrimination is profitable is small).

It is also the case that the vertically integrated firm's revenue losses from engaging in vertical discrimination increase with the difference between the wholesale price and short run incremental cost. Thus, the larger this difference, the less likely a given increase in rivals' costs (which reduces wholesale demand) is profitable, and hence, the less attractive is such behaviour. If, however, the wholesale margin is negative, then there is no ambiguity—raising rivals' costs, unless that is a costly exercise, is profitable. In short, the higher access prices are set, the less likely it is that vertical discrimination will be profitable.

This, however, is only part of the story. In the present context, the regulator wishes to, among other things:

- set a cap that provides appropriate investment incentives without granting the firm unnecessary profits; and
- prevent (to the extent that this is an issue) non-price vertical discrimination.

It is likely that efforts spent on preventing excess profits and non-price vertical discrimination both have positive, diminishing marginal benefits and at least constant, if not increasing, marginal costs. At the same time, by the proceeding analysis there is a natural effort substitutability between the actions the regulator can take. For example, a larger gap between access price and cost reduces the profit gained by discriminating against downstream rivals, so reduces discrimination. In this circumstance, Holmstrom and Milgrom (1991) show that the efficient regulatory response is to reduce the harshness of the extent to which monopoly pricing is sought to be reduced so as to obtain optimal incentives to avoid vertical discrimination.

This easing of price regulation is reinforced by two further factors. First, the need to ensure that appropriate investment incentives complement the regulator's desire to reduce vertical discrimination (which favours accepting more generous access price regulation, such as a more lenient price cap). Second, many efficient actions may well appear discriminatory (for example, it is difficult to determine whether the vertically integrated firm faces lower costs because vertical integration is efficient, or because it discriminates against other firms). As a result, there are likely to be high costs (including as a result of error) associated with enforcing non-discriminatory regulations, or because it leads to inefficiently vertically separated firms (that may still discriminate through contracts and understandings). Moreover, as with price squeezes, these costs are likely to be greater if the regulation is applied *ex ante*, rather than as part of the competition law regime.

It follows that the optimal stance of policy is to err on the side of allowing relatively high access prices (or equivalently, accept relatively lax access price regulation), as such a stance:

- in itself, is a cost-effective approach to reducing the risk of discrimination while preserving efficiencies of vertical integration; and
- is consistent with the need (discussed at length above) to provide credible incentives for investment and avoid or mitigate the risk of *ex post* expropriation.

6. CONCLUDING COMMENTS AND THE TENDER

The federal government is seeking tenders to deploy a NBN that will reach 98 percent of Australia's population (Conroy, 2008). The central tender conditions are that the bidders can seek up to $4 billion of government funding, and that the winning bidder will be required to supply wholesale broadband access to the NBN at a nationally uniform price to all comers. Beyond this, the tender conditions are extremely open, allowing bidders to specify the regulatory framework within which the NBN would be built and supplied.

In this paper, we have examined the regulatory framework that would be appropriate. We have noted that efficient investment will not be forthcoming if there is a risk of sunk investments, once made, being expropriated. Credible commitments are therefore required that reduce this risk, recognising that it is not capable of being entirely eliminated. To this end, and bearing in mind that the current process is being run as a competitive tender (meaning that there will be some degree of rent dissipation), we do not see a convincing case for price regulation. Strengthening our conclusion in this respect is the fact that the network operator, given its cost structure, will have strong incentives to promote use of the new network, and can use price discrimination to do so.

That said, to the extent to which prices are to be regulated, we recommend a light-handed approach based on anchor pricing, that is, on locking in a price for a reference service that acts as a constraint on the prices of other services. We develop also a "floating anchor" model of price regulation which addresses the concern that any anchor price set initially may become less of a constraint over time, as the composition of demand shifts from legacy services to ever-higher speed and service quality levels.

We believe that concerns about vertical discrimination in an NBN are greatly overstated and demonstrate why that is so by analysing the incentives to discriminate. Despite many emotive

and colourative statements to the contrary, and given existing competition law protections, we are unconvinced that additional specific measures are needed to deal with vertical discrimination, all the more so as any such measures are likely to have high economic costs. Given those costs, the most efficient way of dealing with vertical discrimination concerns, beyond relying on TPA remedies, is to adopt a light-handed approach to access price regulation, as higher upstream margins (which are in any event needed for efficient regulation) will reduce the incentives for the network operator to discriminate downstream.

Overall, the policy framework set out above would accommodate the objectives the Government has set. This does not mean, however, that the current NBN process is economically justified. Rather, it might well be preferable to address the deficiencies of the current regulatory arrangements (which, along with possible remedies, are discussed at length in Ergas 2008) and then allow commercial investment decisions to guide the deployment of new networks. Such an approach would avoid the need for government to 'pick winners', and preserve the option value inherent in allowing technologies to be adopted when and only when market circumstances created a compelling case for that to occur.

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